Final Project Report to the NYS IPM Program, Agricultural IPM 2002 – 2003

Title: Using Apple Scab Pseudothecial Squash Mounts for Timing Early Scab Sprays

Project Leader(s):
David A. Rosenberger, Cornell's Hudson Valley Laboratory, Highland, NY

Cooperator(s):
Deborah Breth, Lake Ontario Fruit Team
Kevin Iungerman, Northeastern NY Fruit Program
Mike Fargione, Hudson Valley Fruit Program
Juliet Carroll, NY State Fruit IPM Coordinator

Type of grant:
Monitoring, forecasting, and economic thresholds

Project location(s):
Results of monitoring were used throughout all of NY and portions of New England.

Abstract:
Apple scab is the most important disease of apples in New York State where apples are grown on more than 44,000 acres. Apple growers control apple scab by applying fungicides to prevent infections on leaves and fruit. Growers can avoid unnecessary fungicide sprays if they know when the apple scab ascospores in the over-wintering leaf litter will be released. Eliminating one fungicide spray on all of the apple acreage in New York would save growers approximately $1 million each year. However, eliminating a spray when it is really needed could cause losses equal to at least four times that potential savings. In a project funded by the New York State IPM program, samples of apple leaf litter from eight locations in six counties around New York State were assessed at critical times during spring to determine the status of apple scab ascospore maturation and release. Each of the 12 assessments involved detailed microscopic examinations of the fungal spore-producing structures after they had been removed from the leaf litter. The lead scientist provided results to extension educators who then used e-mail, code-a-phones, faxes, radio spots, and newsletters to inform apple growers about results of scab spore assessments. The scab spore assessments helped apple growers recognize that although spore maturity lagged tree development in the lower Hudson Valley, mature spores were available for discharge when trees in other regions of the state reached bud burst. As a result, Hudson Valley growers were advised to delay their first spray for at least a week after bud-break whereas growers in other regions were advised to protect trees from apple scab as tree produced green tissue. This cooperative effort between scientists and Cooperative Extension field staff contributes to the profitability of the New York apple industry by eliminating unnecessary fungicide sprays and avoiding losses where omitting fungicides would result in losses to apple scab.

Background and justification:
Apple scab is the most important disease of apples in New York State where apples are grown on more than 44,000 acres (Anonymous, 2002). Apple growers control apple scab by applying fungicides to prevent infections on leaves and fruit. The disease is initiated by fungal spores (ascospores) that are released from leaf litter remaining on the ground from the previous year. In most years, the first scab ascospores become available about the same time that the first green tissue appears in apple buds, release of spores peaks during the early stages of apple flowering, and the supply of ascospores is depleted shortly after apple trees reach the petal fall stage of

development. However, factors that affect maturation and release of scab spores are not identical to the factors that govern the rate of bud development in apple trees. As a result, the window for scab spore release may be shifted either forward (earlier in the season) or backward vis-à-vis tree development.

The economic benefits of assessing apple scab development have been presented in a previous report (Rosenberger, 2002). The project was continued in 2002 using similar procedures to those described for 2001.

Objective:

Provide apple growers throughout New York State with reliable information on apple scab ascospore maturity during the interval between the silver tip and half-inch green bud stages.

Procedures:

Samples of apple leaf litter that contained apple scab pseudothecia were collected at critical times during spring by regional fruit specialists in Western NY (Deborah Breth) and northeastern NY (Kevin Iungerman). Similar samples were collected by Frederick Meyer, plant pathology technician, at the Hudson Valley Laboratory in Highland. Optimum timing for sampling was determined via phone consulations or e-mail exchanges between the lead scientist and the sample collectors. Sampling dates were selected with the objective of collecting leaves as close as possible to critical days when growers would be making early-season spray decisions. These decision points generally occur one or two days prior to predicted rain events anytime after green tissue has developed on apple trees in spring. Cooperators in this project attempted to collect and mail samples approximately three to five days ahead of weather systems that might generate the rainfall necessary for scab infection periods.

Leaf samples were sent by over-night mail to the Hudson Valley Lab where we attempted to process samples with 24 hours. Sampling locations are shown in Fig. 1 and included all of the major apple-producing regions within the state. In Wayne and Orleans Counties, samples were collected from two different locations because spore maturity and tree phenology can differ significantly depending on elevation and distance from Lake Ontario.

Additional samples were collected and processed by Dr. Juliet Carroll, Fruit IPM Coordinator, with the objective of learning the sampling and squash mount assessment techniques. Most of these samples were collected at the Geneva Experiment Station, but several came from orchards in Wayne County.

Results and discussion:

A total of 12 pre-bloom scab maturity assessments were completed at the Hudson Valley Lab using leaves collected from eight different locations around New York State (Table 1). Processing of samples in 2002 was complicated by rapid and nearly simultaneous early-season bud development in all parts of the state. As a result, most of the samples needed to be processed over a 10-day period. At the same time, warm weather in the Hudson Valley was shortening the normal time windows for completing other field experiments. Because of the rapid bud development and compressed spring season, some samples could not be processed the day that they were received and turn-around times on the spore counts were greater than in previous years.

Despite the difficulties, the spore maturity assessments still provided useful information. The scab spore assessments showed that although spore maturity lagged tree development in the lower Hudson Valley, mature spores were generally available for discharge when trees in other regions of the state reached bud burst.

Results of the scab spore assessments were evaluated by Rosenberger and action recommendations were forwarded to the regional fruit specialists in the respective regions (Breth, Iungerman, and Fargione). The fruit specialists edited and/or reformatted this information, added their own comments relevant to their specific regions, and then released the information to growers and consultants via radio messages, code-a-phones, e-mail, faxes, and newsletters. Two examples of how this information was presented to fruit growers are shown below in the exerpt from a fruit fax sent to fruit growers in western NY by Deborah Breth, IPM specialist on the Lake Ontario Fruit Team. Kevin Iungerman and Mike Fargione produced similar alerts for apple growers in their respective regions of the state.

Excerpt from Fruit Fax of 12 April, produced by Deborah Breth:

Idared, 20 Oz., Honeycrisp, Gala and McIntosh are at green tip in many locations unless you are on standard trees next to the lake. This all started with the first green tip showing in the area on Tuesday. You need to check bud status in your own blocks. According to the apple scab spore maturity tests, we have a significant level of spore maturity for concern across the region. The Medina site is about 12 miles south of Lake Ontario, and shows significant spore discharge potential from the sample collected Monday. The Newfane site shows a few % mature and ready to shoot, but a lot of time has past since Monday and my bet is we have great potential after this nice pattern we've had of alternating wet and dry weather to mature more spores. Samples were collected from 2 sites in Wayne County on Wednesday, Lyons and Pultneyville; results should be available soon. But we do not have reason to believe there will be big differences between the east and west side of Rochester. If I see anything different in those results, I will do a supplemental fax later in the day.

Ascospore Maturity Assessments (Dave Rosenberger and Fritz Meyer)

Collection date and bud stage	Location	% spores that are			No. of spores in tower shoot test
		Immature	Mature	% empty asci	
April 3 -GT	Highland, Ulster Co.	98%	2%	0%	4 spores
April 3 - ST	Medina, Orleans Co.	91%	9%	0%	7 spores
April 8-ST	Medina, Orleans Co.	78%	22%	0%	181 spores
April 8 –ST	Appleton, Niagara Co.	96%	4%	0%	15 spores

This work was funded by the New York State Integrated Pest Management Program.

The weather forecast is predicting some showers possibly starting Friday night and through Saturday, with temperatures predicted in the mid 70's for Friday, mid 60's through Sunday. It only takes 6 hours of leaf wetness to result in a scab infection with average temperatures in the 60's. Start your fungicide covers in blocks with scab pressure now.

This project provided useful information that could be immediately applied by apple growers throughout the state. Information on apple scab ascospore maturity is essential for deciding when early-season scab fungicides are needed and when they are not. Making the correct decision on early sprays saves growers money by eliminating unnecessary sprays and by helping growers to avoid losses to scab. The information generated in this project was extensively used by private consultants and enhances linkages between private consultants and extension field staff.

The apple scab assessments conducted as part of this project were possible and effective only because of the cooperative effort from the Cooperative Extension field staff who collected and mailed leaves and then disseminated the results. Private consultants also played an essential role in helping growers to use the information to best advantage.

The additional apple scab maturity assessments provided by Dr. Juliet Carroll are summarized in Table 2. Dr. Carroll conducted these assessments primarily to familiarize herself with the process and to determine if, in the future, it would be feasible for her to provide real-time information on apple scab maturity for the western part of New York State. After reviewing results of this season, we will attempt to divide the work in future years between the Hudson Valley Lab and the Geneva Experiment Station so as to avoid the problems encountered this year when all of the counts needed to be completed in a short period of time. An alternative source of funding has been identified to cover the costs of providing this information for the next three years.

Reference:

Anonymous, 2002. The 2001 New York Orchard and Vineyard Survey. NY Agricultural Statistics Service. Available on-line at http://www.nass.usda.gov/ny/special_surveys.htm .

Rosenberger, D. A. 2002. Using apple scab pseudothecial squash mounts for timing early scab sprays. Pg 1-6 in: 2001 New York State Fruit Project Reports Relating to IPM, NYS IPM Publication #219. Cornell University Cooperative Extension, Ithaca, NY.

Table 1: Locations and collections dates for apple leaf samples that were collected for apple scab ascospore maturity assessments performed at the Hudson Valley Lab during spring of 2002, and results of those assessments

Location	County	Date	Apple tree growth stage*	% asci with spores: im-mature	ma-ture	dis-charged	No. of spores dis-charged in tower shoot	Resulting recommendations
Highland	Ulster	Mar 29	ST	99	1	0	0	Ignore 3/30-31 rains
Highland	Ulster	Apr 3	GT	98	2	0	4	Ignore 4/3 rains
Highland	Ulster	Apr 8	QIG	95	5	0	0	Ignore 4/9 rains
Highland	Ulster	Apr 12	HIG	80	20	0	84	Spray for 4/12 rains
Medina	Orleans	Apr 3	ST	91	9	0	7	Start sprays at GT
Medina	Orleans	Apr 8	ST	78	22	0	181	Start sprays at GT
Newfane	Niagara	Apr 8	ST	96	4	0	15	Spore maturity lagging
Appleton	Niagara	Apr 15	HIG	54	45	1	225	Small discharge from rains of 4/13-14
Lyons	Wayne	Apr 10	ST	81	19	0	60	Start sprays at GT
Pultneyville	Wayne	Apr 16	HIG	62	37	1	505	Small discharge from rains of 4/13-14
Schuylerville	Saratoga	Apr 8	ST	90	10	0	61	Start sprays at GT
Peru	Clinton	Apr 15	GT	65	34	1	358	Start sprays ASAP

*ST=silver tip; GT=green tip; QIG=quarter-inch green; HIG=half-inch green.

Figure 1: Locations in New York State where samples were collected for apple scab ascospore assessments during spring of 2001.

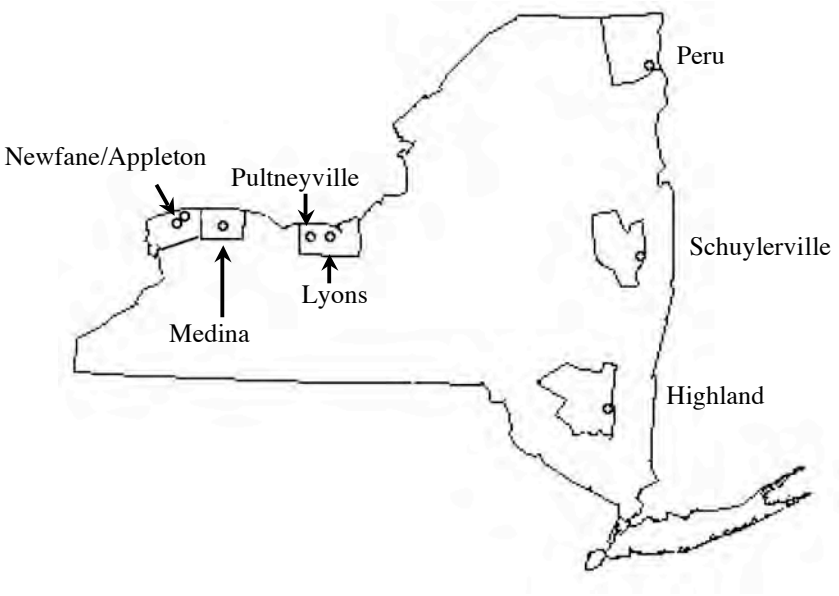

Table 2: Locations and collections dates for apple leaf samples that were collected for apple scab ascospore maturity assessments performed at the Geneva Experiment Station during spring of 2002, and results of those assessments

				% asci with spores that are:		
Location	County	Date		immature	mature	discharged
Lyons	Wayne	Apr 10	ST	87	13	0.5
Pultneyville	Wayne	Apr 10	ST	93	7	0.2
Geneva	Ontario	April 9	ST	100	0	0
Geneva	Ontario	April 24	TC	79	14	7
Geneva	Ontario	April 29	ST	82	10	6